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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/508,748 | 02/07/2005 | Giulio Alberti | 26332 | 8351 |

20529 7590 06/13/2007
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Alexandria, VA 22314

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| EXAMINER |
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BERNSHTEYN, MICHAEL

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| ART UNIT | PAPER NUMBER |
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1713

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| MAIL DATE | DELIVERY MODE |
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06/13/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|---------------------------------------|---------------------------------------|--|
| Office Action Summary | Application No. 10/508,748 | Applicant(s) ALBERTI ET AL. | |
| | Examiner Michael Bernshteyn | Art Unit 1713 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☒ Claim(s) 2-6, 9, 12-14, 16-24, 27-29 and 31 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 September 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>01/11/06, 02/07/05, 03/22/06</u> | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

1. It is noted that the preliminary amendment filed on September 21, 2004 was inadvertently overlooked during the prosecution of the previous Office Action dated on April 5, 2007. Therefore, it will be superseded by the instant non-final Office Action. Accordingly, the three months shortened statutory period will be restarted from the mailing date of this Office Action.

Claim Objections

2. Claims 2-6, 9, 12-14, 16-24 and 27-29 are objected to because of the following informalities: the use of the phrases "preferably", "more preferably", etc. to link a broad range of values with a narrow range of values renders the claims awkward and not in the compliance with the current US practice. It is not clear which range controls the actual metes and bounds of the claimed subject matter. It is suggested to put preferable range in the dependent claims. Appropriate correction is required.

3. Claims 11, 12, 13 and 31 are objected to because of the following informalities: the use of the phrase "especially" or "specially" to link a broad range of values with a narrow range of values renders the claims awkward and not in the compliance with the current US practice. It is not clear which range controls the actual metes and bounds of the claimed subject matter. It is suggested to put preferable range in the dependent claims. Appropriate correction is required.

4. Claim 6 is objected to because of the following informalities: the word "arylene" should have letter "e" at the end. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 8, 10, 14, 17, 18, 25 and 27-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 8 in line 4 recites "various alkanols"; claim 10 in line 9 recites "the wished percentage"; claim 14 in line 4 recites "between" and claim 32 in line 2 recites "of the state of the art". All these terms are indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 17, 18, 25 and 27-33 provide for the use of the organic solutions, proton conducting membranes and composite membranes but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claims 17, 18, 25 and 27-33 are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd. v. Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35

U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-33 are rejected under 35 U.S.C. 102(a) as being anticipated by Bauer et al. (WO 03/077340 A2). The U.S. Patent 7,108,935 is equivalent to the WO 03/077340 A2, therefore the following rejection is based upon the context of U.S. Patent 7,108,935.

With regard to the limitations of claims 1-33, Bauer discloses composite membrane materials comprising a polymer of the state of art uniformly filled with a zirconium phosphate, preferably α -zirconium phosphate or zirconium phosphate sulfoarylenphosphonate particles. The composite membrane materials are preferably prepared starting from a solution of a polymer of the state of art and from a colloidal dispersion of α -zirconium phosphate or a zirconium phosphate sulfoarylenphosphonate. The colloidal particles are transferred into the solution of the polymer preferably by mixing the dispersion with the solution or by means of phase transfer. The membrane material is preferably obtained by removing the solvent by evaporation or by a suitable non-solvent. Besides the composite membrane materials and the preparation

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methods, the use of the above membrane materials is claimed as ionomeric membranes with high overall performance in high temperature, especially hydrogen, and in indirect methanol fuel cells and with decreased methanol crossover in direct methanol fuel cells (abstract).

Bauer discloses that it is known from the literature (G. Alberti, M. Casciola, U. Costantino, A. Peraio, E. Montoneri, Solid State Ionics 50 (1992) 315; G. Alberti, L. Boccali, M. Casciola, L. Massinelli, E. Montoneri, Solid State Ionics 84 (1996) 97) that some α - or γ -layered zirconium phosphate sulfoarylenphosphonates exhibit proton conductivity up about 0.1 S cm^{-1} . These compounds are represented by the general formulae $\text{Zr}(\text{O}_3\text{POH})_{2-x}(\text{O}_3\text{P--Ar})_x \cdot n\text{H}_2\text{O}$, with $0 < x \leq 2$ (α -type compounds), or $\text{Zr}(\text{PO}_4)(\text{O}_2\text{P}(\text{OH})_2)_{1-x}(\text{HO}_3\text{P--Ar})_x \cdot n\text{H}_2\text{O}$, with $0 < x \leq 1$ (γ -type compounds), where Ar is an arylensulfonated group.

These compounds are substantially identical to the claimed insoluble compounds of instant claim 1.

Bauer discloses that both amorphous and α - or γ -layered zirconium phosphate as well as zirconium phosphate metasulfoarylenphosphonates form stable colloidal dispersions in some **organic solvents** (e.g. N,N'-dimethylformamide (DMF), N-methyl-2-pyrrolidone (NMP), dimethylsulfoxide, acetonitrile, alkanols) or in their mixtures with water (col. 3, lines 3-9).

Bauer discloses that conductivity of a modified zirconium phosphate, especially zirconium phosphate sulfoarylenphosphonate, containing membrane

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material is $>10^{-2} \text{ S cm}^{-1}$ at 70°C and 95% relative humidity, which is within the claimed range (col. 3, lines 41-44).

The preparation of a colloidal dispersion of α -zirconium phosphate or of a proton conducting zirconium phosphate sulfoarylenphosphonate in a suitable solvent or mixture of solvents, and in the subsequent transfer of the colloidal particles into a solution of a polymer, especially an ionomer, of the state of art. The mixture thus obtained is cast on the surface of a smooth plane support and the solvent is removed by heating or by using a suitable non-solvent. Transfer of the colloidal particles into the polymer, especially ionomer, solution can be carried out (1) by mixing the polymer, especially the ionomer, solution with the colloidal dispersion or (2) by means of "phase transfer". It is possible to use noncharged polymers as conductivity is contributed by the zirconium phosphate. Preferably there are used ionomers, especially sulfonated polymers due to their conductivity at low temperatures ($<100^{\circ}\text{C}.$). There can be used **perfluorosulfonic polymers**, especially Nafion, Hyflon or Sterion, **sulfonated polyvinylidenefluoride**, **sulfonated polyetherketones**, especially sPEK, sPEEK, sPEKK, sPPEK, sPEEKK or sPEKEKK, sulfonated polybenzimidazoles, sulfonated polysulfones sulfonated polyphenylsulfones and **sulfonated polyethersulfones**. In case (1) the same solvent can be used for the solution and the dispersion. Alternatively, if different solvents are used for the solution and the dispersion, it must be avoided that the solvent of the polymer may provoke colloid flocculation and the solvent of the colloidal dispersion may cause polymer precipitation (col. 3, line 58 through col. 4, line 18).

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7. Claims 1-6 are rejected under 35 U.S.C. 102(a) as being anticipated by Alberti et al. (U. S. Patent 5,892,080).

With regard to the limitations of claims 1-6, Alberti discloses solid mesoporous crystalline composition of diphosphonate-phosphite of a tetravalent metal, with a limited distribution of mesopores having the formula (abstract):



wherein: M is a tetravalent metal, R is a bivalent organic radical, x varies from 0.3 to 0.6, y varies from 0.05 to 0.3. The process for its production is described, together with its uses and a solid catalyst containing $-SO_3H$ acid groups, active in the conversion processes of hydrocarbons, which can be obtained from said mesoporous crystalline composition by treatment with a sulfonicphosphonic or arylphosphonic acid, followed, only in the case of treatment with arylphosphonic acid, by sulfonation with a sulfonating agent.

In particular, in the above formula, M is a **tetravalent metal**, which can be conveniently selected from **zirconium**, **titanium** and tin, and is preferably zirconium owing to the greater stability to hydrolysis of the relative composition (col. 2, lines 54-61). R is selected from aliphatic bivalent organic radicals containing from 2 to 10 carbon atoms in the molecule, or aromatic radicals containing from 1 to 2 non-condensed rings, or from alkylaromatic radicals. Specific examples of R radical are: $--CH_2CH_2--$, $--CH_2--(CH_2)_2--CH_2--$, $--CH_2--(CH_2)_4--CH_2--$, $--C_6H_4--$, $--C_6H_4--C_6H_4--$, $--CH_2--C_6H_4--CH_2--$, $--CH_2--C_6H_4--C_6H_4--CH_2--$. Preferred examples of the R radical are $--C_6H_4--$ and $--CH_2(CH_2)_2--CH_2--$ (col. 2, lines 58-61).

The preferred oxychloride of a tetravalent metal is selected from **zirconyl chloride octahydrate** and **zirconyl chloride monohydrate** (col. 3, lines 50-52).

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Alberti discloses that the solvent can be water, or an **organic solvent**, or a mixed water/organic solvent, preferably dioxane (col. 5, lines 22-25).

8. Claims 1-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Grot et al. (U.S. Patent 5,919,583).

Grot discloses cation exchange membranes, made from polymer having cation exchange groups and containing inorganic filler, exhibit reduced fuel crossover for fuel cells employing direct feed organic fuels such as methanol and, when inorganic proton conductor is employed, enhanced proton conductivity (abstract).

With regard to the limitations of claims 1-33, Grot discloses that zirconium hydrogen phosphate $Zn(HPO_4)_2$ can be precipitated in a membrane of perfluorinated sulfonic acid polymer (preferably in acid form) by soaking the membrane in an aqueous solution of containing zirconium ions, e.g., 1-5M zirconyl chloride, for a time and at a temperature sufficient to penetrate the membrane solution (col. 7, lines 8-15, example 1, col. 10, line 64 through col. 11, line 42). The cation exchange groups are preferably selected from the group consisting of sulfonate, carboxylate, phosphonate, imide, sulfonamide and sulfonamide groups (col. 3, lines 29-35).

The membrane may optionally include a porous support for the purposes of improving mechanical properties, for decreasing cost and/or other reasons. The porous support of the membrane may be made from a wide range of components. The porous support of the present invention may be made from a hydrocarbon such as a polyolefin, e.g., polyethylene, polypropylene,

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polybutylene, copolymers of those materials, and the like. Perhalogenated polymers such as polychlorotrifluoroethylene may also be used. For resistance to thermal and chemical degradation, the support preferably is made of a highly fluorinated polymer, most preferably **perfluorinated polymer** (col. 5, lines 1-12).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Bernshteyn whose telephone number is 571-272-2411. The examiner can normally be reached on M-F 8-5:30.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu can be reached on 571-272-1114. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael Bernshteyn
Patent Examiner
Art Unit 1713

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